IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Lin et al.	Group Art Unit: 1794
Application No: 10/691,418 Confirmation No: 6173	Examiner: Daniel H. MILLER
Filed: October 22, 2003	Attorney Docket No: 008716 USA/AGS/SPARES/DP
Title: CLEANING AND REFURBISHING CHAMBER COMPONENTS HAVING METAL COATINGS	January 14, 2009 San Francisco, California

OK TO ENTER

RESPONSE TO FINAL OFFICE ACTION

VIA ELECTRONIC FILING

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

/Daniel Miller/ 01/25/2009

Examiner Miller:

This communication is in response to the Final Office Action mailed on October 14, 2008, and is being timely filed within three months thereof.

CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, facsimile transmitted to the U.S. Patent Office at (571) 273-8300, or filed electronically via EFS on the date shown below.

By: Amy Wells Date: January 14, 2009

IN THE CLAIMS

Please amend the claims as shown in the following listing of claims, which replaces all prior versions and listings of claims in the present application:

1-17. Cancelled.

18. (Currently amended) A refurbished component for a process chamber, the component comprising a titanium structure having a refurbished textured titanium metal coating ~~over an intermetallic compound~~, wherein the component is refurbished by:

(i) immersing the component in a cleaning solution to remove an original titanium coating to expose an intermetallic compound on the titanium structure of the component;

(ii) removing the intermetallic compound by bead blasting with blasting beads having a bead diameter of less than about 180 micrometers propelled by a gas pressurized to a pressure of less than about 310 kPa to form an exposed surface of the structure;

(iii) texturizing the exposed surface of the titanium structure by bead blasting with blasting beads having a bead diameter of less than about 1000 micrometers that are propelled by a gas pressurized to a pressure of less than about 414 kPa, to form a textured surface having a surface roughness average of from about 3.81 micrometers to about 8.89 micrometers; and

(iv) forming the refurbished <u>textured</u> titanium metal coating on the textured surface by twin-wire arc spay coating,

whereby the refurbished component is capable of being refurbished by the method at least about 15 times substantially without failure of the component.

19. (Previously presented) A component according to claim 18 wherein the component comprises at least a portion of an enclosure wall, chamber shield, target, cover ring, deposition ring, support ring, insulator ring, coil, coil support, shutter disk, clamp shield or substrate support.

20. (Previously presented) A substrate processing chamber component comprising:

(a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and

(b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

21-22. Cancelled.

23. (Previously presented) A component according to claim 20 wherein the titanium metal coating comprises a twin-wire arc sprayed titanium coating.

24. (Previously presented) A substrate processing chamber component comprising:

(a) a structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and

(b) a titanium metal coating on the titanium structure, the titanium coating having a textured surface.

25. Cancelled.

26. (Previously presented) A component according to claim 24 wherein the titanium metal coating comprises a twin-wire arc sprayed titanium metal coating.

27. (Previously presented) A component according to claim 18 wherein the intermetallic compound comprises at least one of aluminum, titanium, stainless steel, copper and tantalum.

28. (Previously presented) A component according to claim 18 wherein in (i) the cleaning solution comprises an acidic or basic solution to dissolve the titanium metal coating.

29. (Previously presented) A component according to claim 18 wherein in (i) the cleaning solution comprises HF and HNO_3.

30. (Previously presented) A component according to claim 18 wherein (ii) comprises bead blasting the intermetallic compound with blasting beads having a bead diameter greater than about 80 micrometers.

31. (Previously presented) A component according to claim 18 wherein (ii) comprises bead blasting the intermetallic compound by propelling blasting beads towards the intermetallic compound with a gas that is pressurized to a pressure of greater than about 172 kPa.

32. (Previously presented) A component according to claim 18 wherein in (iii) the texturizing bead blasting step comprises propelling blasting beads having a bead diameter of greater than about 400 micrometers at the exposed surface of the structure with gas that is pressurized to a pressure of at least about 276 kPa.

33. (Previously presented) A component according to claim 18 wherein the exposed surface of the structure comprises crevices, and wherein the bead diameter is selected to be smaller than the average width of the crevices, whereby the blasting beads can penetrate into the crevices to remove the intermetallic material.

34. (Previously presented) A component according to claim 18 wherein (iv) comprises generating an electrical arc that at least partially liquefies a titanium coating material, and passing a pressurized gas past the liquefied titanium coating material to propel the liquefied coating material towards the textured surface.

35. (Previously presented) A substrate processing chamber component comprising:

(a) a structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and

(b) a titanium metal coating on the titanium structure, the titanium metal coating comprising a twin-wire arc sprayed titanium metal coating having a textured surface.

36. (Previously presented) A component according to claim 35 wherein the titanium structure comprises at least a portion of one or more of an enclosure wall, a chamber shield, a cover ring and a deposition ring.

37. (Previously presented) A substrate processing chamber component comprising:

(a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and

(b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

38. Cancelled.

REMARKS

Claims 18-20, 23, 24, and 26-37 are pending in the application, of which claim 18 is amended.

Claim 18 is amended to remove "over an intermetallic compound". This amendment is made to clarify the language of the Claim 18 and is not intended to change the scope of the claim.

The amendment to claim 18 to remove "over an intermetallic compound" is supported by the Specification as filed. The specification teaches cleaning of an intermetallic compound from a process chamber component structure at pages 9, lines 1-17. The Specification further teaches that the coating comprising the metal layer is applied to the cleaned surface (page 13, lines 1-4).

Claim 18 is also amended to specify that the refurbished titanium metal coating is a "textured titanium metal coating". This amendment is to clarify the claim language.

Claim 18 is further amended to replace of "spay" with "spray" to clarify the language of Claim 18 and to correct an obvious typographical error.

The amendment to claim 18 is not a narrowing of the scope of the properly construed claim. TurboCare v. General Electric Co., 264 F.3d 1111 (Fed. Cir. 2001); Bose Corp. v. JBL, Inc., 274 F.3d 1354 (Fed. Cir. 2001); and Interactive Pictures Corp. v. Infinite Pictures, Inc., 274 F.3d 1371 (Fed. Cir. 2001). The amendment does not affect scope of the claim, and consequently, does not invoke the Festo rules and the scope of the doctrine of equivalents applied to the claims should not be limited under the rules of Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 2002 Lexis 3818 (May 28, 2002).

The claim amendments add no new matter and their entry is respectfully requested.

Discrepancy in Office Action

The teachings described in the Final Office Action at page 3, paragraphs 2 and 3 are not present in the cited Lin et al. 2003/0026917A1.

Applicant requested clarification from the Examiner regarding the cited references by telephone on January 7, 2009, but the Examiner declined the same.

Accordingly, this response is presented to the Final Office Action and 103(a) rejection as issued.

Claim Rejections under 35 U.S.C. § 103

Claims 18-20, 23-24 and 26-37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin (US 2003/0026917A1, hereinafter "Lin '917") in view of Garg (US 5,009,966).

A prima-facie obviousness rejection requires that prior art references, when combined, teach or suggest the invention as a whole. Prior art references that are combined must teach or suggest all the claim limitations. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). In making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires consideration of the claimed invention "as a whole." Princeton Biochemicals, Inc. v. Beckman Coulter, Inc. (Fed. Cir., No. 04-1493, 6/9/05).

The examiner has failed to make a prima-facie obviousness rejection because the prior art references, either singly or when combined, fail to teach or suggest each and every limitation set forth in claim each of claims 18, 20, 24, 35 and 37.

Claim 18

Li '917 and Garg, either singly or when combined, fail to teach or suggest all of the limitations of claim 18, which is to: a refurbished component for a process chamber, the component comprising a titanium structure having a refurbished textured titanium metal coating, wherein the component is refurbished by: (i) immersing the component in a cleaning solution to remove an original titanium coating to expose an intermetallic compound on the titanium structure of the component; (ii) removing the intermetallic compound by bead blasting with blasting beads having a bead diameter of less than about 180 micrometers propelled by a gas pressurized to a pressure of less than about 310 kPa to form an exposed surface of the structure; (iii) texturizing the exposed surface of the titanium structure by bead blasting with blasting beads having a bead diameter of less than about 1000 micrometers that are propelled by a gas pressurized to a pressure of less than about 414 kPa, to form a textured surface having a surface roughness average of from about 3.81 micrometers to about 8.89 micrometers; and (iv) forming the refurbished textured titanium metal coating on the textured surface of the titanium structure by twin-wire arc spray coating,

Claim 18 recites: "A refurbished component for a process chamber, the component comprising a titanium structure...". Lin '917 does not teach a process chamber component comprising a titanium structure. Instead, Lin '917 teaches components fabricated from metal and ceramic materials:

> A portion or all of the process chamber 100 may be fabricated from metal or ceramic materials. Metals that may be used to fabricate the process chamber 100 include aluminum, anodized aluminum, "HAYNES 242," "Al-6061," "SS 304," "SS316," and INCONEL, of which anodized aluminum is sometimes preferred. For example, in one version, the process chamber 100 comprises an enclosure wall 120 that is fabricated from a ceramic material that is substantially permeable to RF wavelengths, such as quartz.

[Lin '917, page 2, paragraph 20]

The material "Al-6061" is an aluminum alloy, and the material "INCONEL" is a nickel and chromium alloy. Al-6061 and INCONEL alloys can include trace amounts of titanium. However, the titanium concentration in Al-6061 is about 0.15% by mass, and in INCONEL, titanium is included in a concentration of 0.4% by mass, or less. Thus, teachings to Al-6061 and INCONEL are not teachings to a process chamber component "...comprising a **titanium structure**.." as recited in claim 18.

The examiner says in page 3 of the Office Action that Lin '917 teaches a titanium structure. However, teachings to a titanium structure are not found in Lin '917. For example, the Office Action states:

> Lin teaches a substrate processing chamber component comprising: (a) a structure shaped to be a chamber enclosure wall, gas shield, cover ring or deposition ring, the structure made from stainless steel, aluminum, **titanium**, copper, copper alloy, quartz or aluminum oxide; and (b) a textured coating on the structure, textured coating: (i) made from aluminum, silicon, aluminum oxide, boron carbide or titanium oxide, and (ii) consisting essentially of substantially flower shaped surface grains that are sized from about 0.1 to about 5 micron (claim 20 Lin).
>
> Given that the structure of the disclosed art and the claimed invention are substantially similar with both having substantially similar surface roughness (see table 1 Lin) and thickness [0052] with substantially similar deposition techniques [0051] they would be expected to have like physical characteristics, as claimed by applicant. No patentable distinction is seen.

[Office Action, page 3, paragraphs 2 and 3]. Further, none of claim 20 and paragraphs [0051] and [0052] of Lin '917 correspond to these teachings. For example, Claim 20 of Lin '917 reads:

> **20**. A method according to claim 16 wherein (c) comprises injecting a ceramic powder through a plasma arc formed by maintaining a current between two electrodes of about 600 Amps.

The missing teachings are also not present in claim 16 of Lin '917, from which claim 20 depends:

> **16**. A method of fabricating a domed enclosure wall of a plasma processing chamber, the method comprising:
>
> (a) providing a domed shaped dielectric preform;
>
> (b) roughening a surface of the dielectric preform to form a roughened surface having a roughness average of from about 150 to about 450 microinches; and
>
> (c) depositing a plasma sprayed ceramic coating on the roughened surface of the dielectric preform so that the plasma sprayed ceramic coating comprises a textured exposed surface having a roughness with an average skewness that is a negative value.

Lin '917 also does not teach or suggest a process chamber component having a "titanium metal coating" or a "metal coating", as recited in claims 18. Instead, the coating of the component of Lin '917 is a ceramic coating. For example, Lin '917 teaches:

> [**0036**] The component **410** is surface roughened to particular levels that provide at least some of the final texture of the exposed surface **422**. The roughened surface **436** is coated with a plasma sprayed coating **420** that at least partially conforms to the surface **436** while also imparting additional texture characteristics, to provide a textured exposed surface **422** that significantly improves the adhesion of the sputter etched material onto the component **410**. The coating **420** may be made of a material **425**, such as a ceramic material, such as, for example, Al_2O_3, TiO_2, or mixtures thereof.

[Lin '917, page 4, paragraph 36] Thus, in one version, the coating of Lin '917 can comprise titanium oxide. However, even Lin '917 recognizes titanium oxide as a ceramic material, which is distinct from a "metal coating" as claimed.

Further, the component and coating of Lin '917 also does not comprise a coating formed by "twin-wire arc spray", as recited in claim 18. The components of Lin '917 are coated with a ceramic that is applied from a ceramic powder that is plasma sprayed. The plasma spray application method of Lin '917 is disclosed in paragraph 43, which states:

> [0043] After cleaning of the component surface **436**, a coating **420** is plasma sprayed onto the surface **436** as for example, as illustrated in **FIG. 3***b*. In plasma spraying, a plasma is formed to atomize and at least partially liquefy a spray of particulate coating material **425** injected through the plasma. For example, the plasma may liquefy the coating material **425** by heating the coating material **425** to a temperature of thousands of degrees Celsius. The liquified droplets of the coating material **425** impinge at high velocities on the roughened underlying surface **436** and rapidly solidify to form a conformal coating **420**, as shown in **FIG. 3***c*.

[Lin '917, page 5, paragraph 43]. Thus, Lin '917 teaches atomizing and liquefying of a spray of particulate coating material and not "twin-wire arc spray," which uses a wire.

Garg fails to make up for the deficiencies of Lin '917 because Garg also does not teach a process chamber component comprising a titanium metal coating on a titanium structure as claimed. A titanium metal coating on a titanium structure is one that is in diret contact with the underlying titanium structure. Instead, Garg et al. teaches coated substrates having an intervening non-reactive noble metal interlayer that lies in-between the underlying structure and the coating. Garg et al. further teaches that a non-reactive noble metal interlayer is necessary when applying coatings to a titanium structure:

> "... Because of their reactivity to halogenated reagents, it is difficult to chemically vapor deposit hard protective coatings that strongly adhere to titanium or titanium alloys. This is true because the halogenated reagents and their reaction products in the CVD and CVD-like processes react with the titanium and titanium alloys, causing spalling of the deposited coating. In the case of PVD processes, stresses due to the mismatch of the coefficients of thermal expansion can lead to poor adhesion and spalling."

[Garg et al., Column 1, lines 24-33].

> "Therefore, it is desirable to deposit adherent noble material on titanium and titanium alloys prior to coating them with ceramics, hard metal and metal compounds."

[Garg et al., Column 2, lines 15-18].

One of ordinary skill in the art would not combine the titanium coating of Garg with the teachings of Lin '917 because Lin '917 teaches a ceramic coating and not a

metal coating. Metal and ceramic have distinct properties and one would not arrive at a metal coating from teachings to a ceramic coating.

Further, there is no expectation that the combination of the coating of Garg with the component of Lin '917 would result in the claimed component and coating because Garg et al. teaches the desirability of depositing an adherent noble material as an interlayer between a coating and an underlying structure. Garg et al. even suggests that direct coating of titanium metal onto titanium substrates, without the noble metal interlayer, can cause spalling. Thus, even the combination of Garg with Lin '917 would not result in a titanium metal coating on a titanium structure, as claimed in claim 18.

For at least these reasons claim 18, and claims 19 and 27-34 which depend therefrom, are not obvious over Lin '917 in view of Garg.

Claim 20

Li '917 and Garg, considered singly or when combined, also fail to teach or suggest each and every limitation of claim 20, which is to: a substrate processing chamber component comprising: (a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

As discussed above with reference to claim 18, Li '917 does not teach a substrate processing chamber component comprising "a titanium structure" as claimed in claim 20. Li '917 also does not teach a "metal coating" or a "titanium metal coating" on the titanium structure. Instead, the coatings of Li '917 are ceramic coatings. Garg does not make up for the deficiencies of Li '917 because Garg does not teach a titanium metal coating that is on the titanium structure.

Further, one of ordinary skill would not be motivated to substitute the metal coating of Garg with the components of Li '917 because Li '917 teaches ceramic coatings. In the unlikely event that one does combine Garg with Li '917, this

combination would still not result in the claimed component, which has a metal coating that is on the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Li '917 an Garg do not render claim 20 unpatentable, nor claim 23 which depends therefrom.

Claim 24

Li '917 and Garg, considered singly or when combined, fail to teach or suggest each and every limitation of claim 24, which is to: a substrate processing chamber component comprising: (a) structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

As discussed above with reference to claim 18, Li '917 does not teach a substrate processing chamber component comprising "a structure made from titanium" as claimed in claim 24. Li '917 also does not teach a "metal coating" or a "titanium metal coating" on the component structure. Instead, the coatings of Li '917 are ceramic coatings. Garg does not make up for the deficiencies of Li '917 because Garg also does not teach a titanium metal coating that is on the titanium structure.

One of ordinary skill would not be motivated to substitute the metal coating of Garg with the components of Li '917 because Li '917 teaches ceramic coatings. Further, combination of Garg with Li '917 would not result in the claimed component which has a metal coating that is on the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Li '917 and Garg do not render claim 24 unpatentable, nor claim 26 which depends therefrom.

Claim 35

Li '917 and Garg, considered singly or when combined, also fail to teach or suggest each and every limitation of claim 25, which is to: a substrate processing chamber component comprising: (a) a structure made from titanium, the titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

As discussed above with reference to claim 18, Li '917 does not teach a substrate processing chamber component comprising "a structure made from titanium" as claimed in claim 35. Li '917 also does not teach a "metal coating" or a "titanium metal coating" on the structure. Instead, the coatings of Li '917 are ceramic coatings. Garg does not make up for the deficiencies of Li '917 because Garg does not teach a titanium metal coating that is on the titanium structure.

One of ordinary skill would not be motivated to substitute the metal coating of Garg with the components of Li '917 because Li '917 teaches ceramic coatings. Further, combination of Garg with Li '917 would not result in the claimed component which has a metal coating that is on the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Li '917 and Garg do not render claim 35 unpatentable, nor claim 36 which depends therefrom.

Claim 37

Li '917 and Garg, considered singly or when combined, further fail to teach or suggest each and every limitation of claim 37, which is to: a substrate processing

chamber component comprising: (a) a titanium structure comprising at least a portion of an enclosure wall, chamber shield, cover ring or deposition ring; and (b) a titanium metal coating on the structure, the titanium metal coating having a textured surface.

As discussed above with reference to claim 18, Li '917 does not teach a substrate processing chamber component comprising "a titanium structure" as claimed in claim 37. Li '917 also does not teach a "metal coating" or a "titanium metal coating" on the component. Instead, the coatings of Li '917 are ceramic coatings. Garg does not make up for the deficiencies of Li '917 because Garg does not teach a titanium metal coating that is on the titanium structure.

One of ordinary skill would not be motivated to substitute the metal coating of Garg with the components of Li '917 because Li '917 teaches ceramic coatings. Further, combination of Garg with Li '917 would not result in the claimed component which has a metal coating that is on the titanium structure, because Garg teaches providing a noble metal interlayer between a coating and an underlying structure and further emphasizes that this interlayer is necessary to prevent spalling.

For at least these reasons, Li '917 and Garg do not render claim 37 unpatentable.

CONCLUSION

The above amendments and remarks are believed to place the application in condition for allowance. Should the Examiner have any questions regarding the present amendment, the Examiner is requested to call the undersigned representative at: (415) 538-1555.

Respectfully submitted,
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